

High-resolution spectroscopy, crystal-field calculations, and quadrupole helix chirality of DyFe₃(BO₃)₄

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Abstract

© The Authors, published by EDP Sciences. High-resolution polarized transmission spectra of Dy Fe₃ (BO₃)₄ single crystals were investigated in broad spectral (10-23000 cm⁻¹) and temperature (3.5-300 K) ranges. Energies of the dysprosium levels in the paramagnetic and antiferromagnetic phases were determined. On the basis of these data and preliminary calculations in the frameworks of the exchange-charge model, we determined the crystal-field and Dy-Fe exchange interaction parameters of the Dy³⁺ ions at sites with the point C₂ symmetry corresponding to the enantiomorphic P3121 and P3221 space groups. The values of electronic quadrupole moments of the Dy³⁺ ions were calculated, which enabled us to interpret results of the work [Usui et al., Nature Mater. 13, 611 (2014)] on the observation of domains of different quadrupole chirality in DyFe₃(BO₃)₄.

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